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(71) Applicant  
Fluoroware Inc

(Incorporated in the USA - Minnesota)

102 Jonathon Boulevard North, Chaska,  
Minnesota 55318, United States of America

(72) Inventors

Robert Dean Kos  
Shawn Daniel Eggum

(74) Agent and/or Address for Service

Abel & Imray  
Northumberland House, 303-306 High Holborn,  
London, WC1V 7LH, United Kingdom

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(54) Box for storing a wafer carrier

(57) A plastic moulded box for storing a carrier for semiconductor wafers has a box bottom 11 and a cover 12 connected together by a two-part demountable hinge assembly 13. The two parts 77, 78 of the hinge assembly 13 are secured together throughout the normal opening and closing of the cover 12. The hinge parts 77, 78 are demountable with respect to each other when the cover 12 has swung through and beyond the normal opened position where the cover 12 rests upon the surface upon which the box bottom 11 engages. When the cover 12 is swung lower than the box bottom 11 the hinge parts 77, 78 will separate from each other.

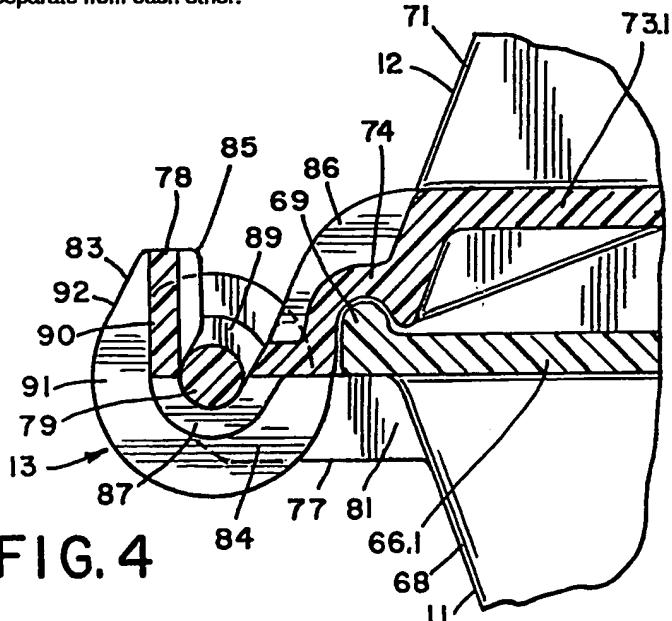
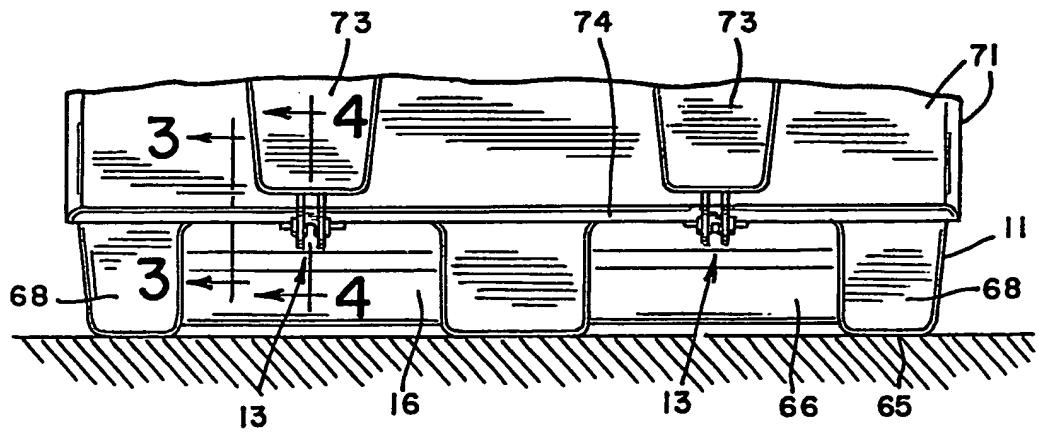
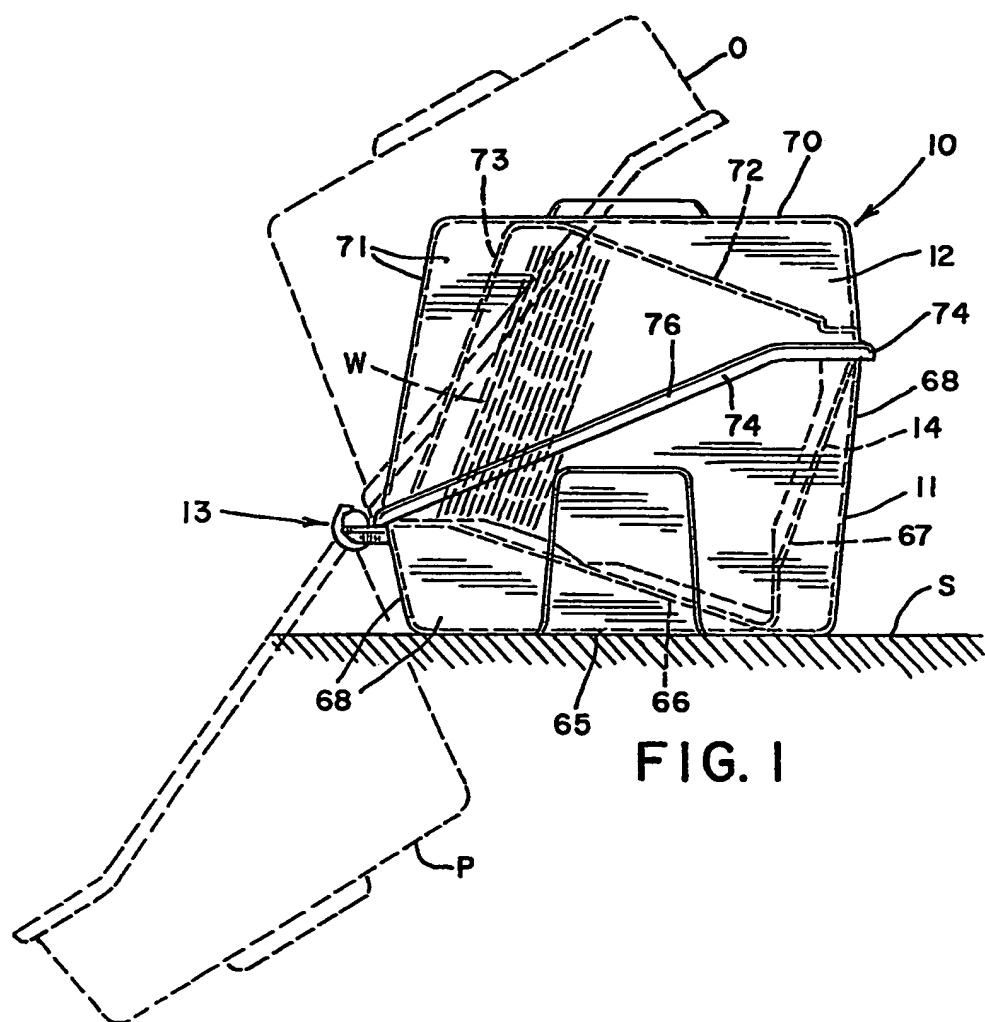


FIG. 4

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**FIG. 2**

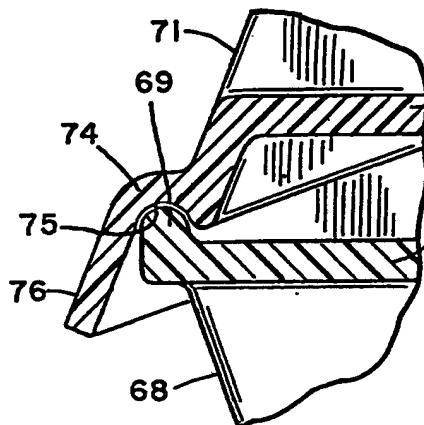


FIG. 3

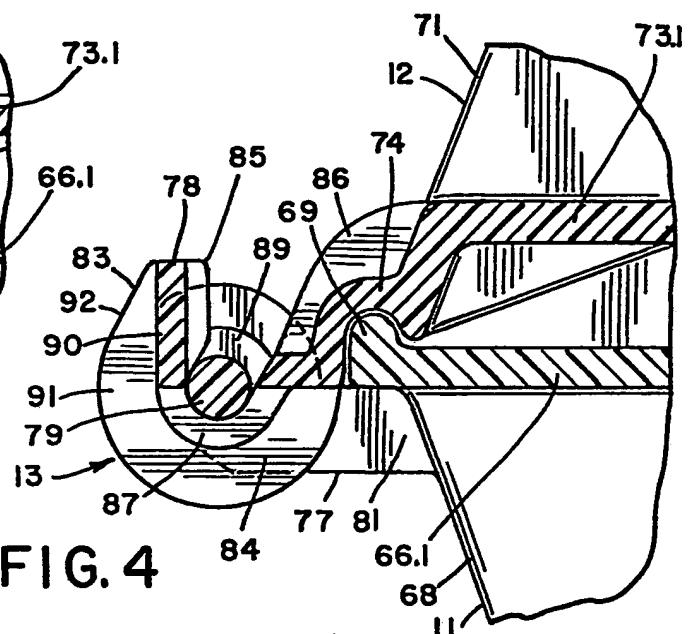


FIG. 4



FIG. 5

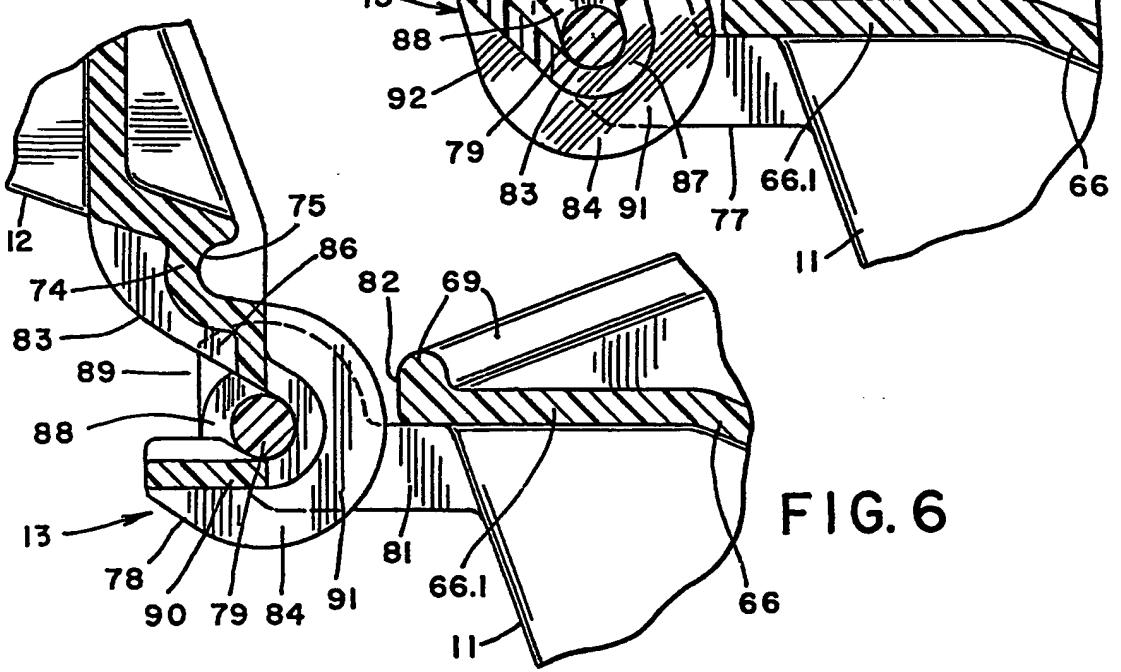
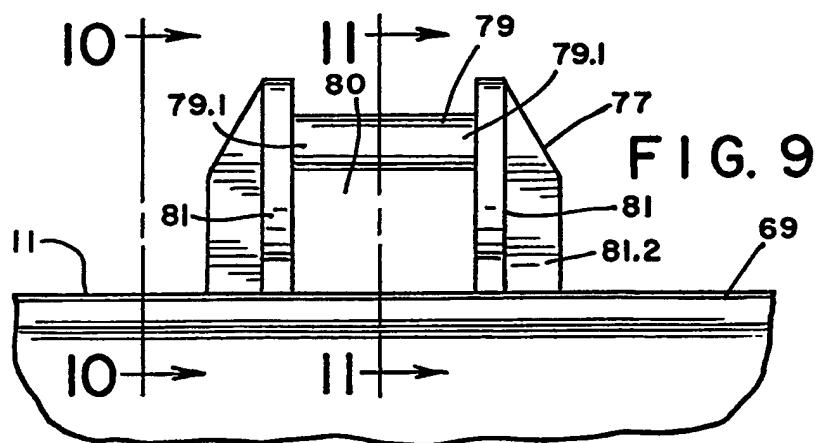
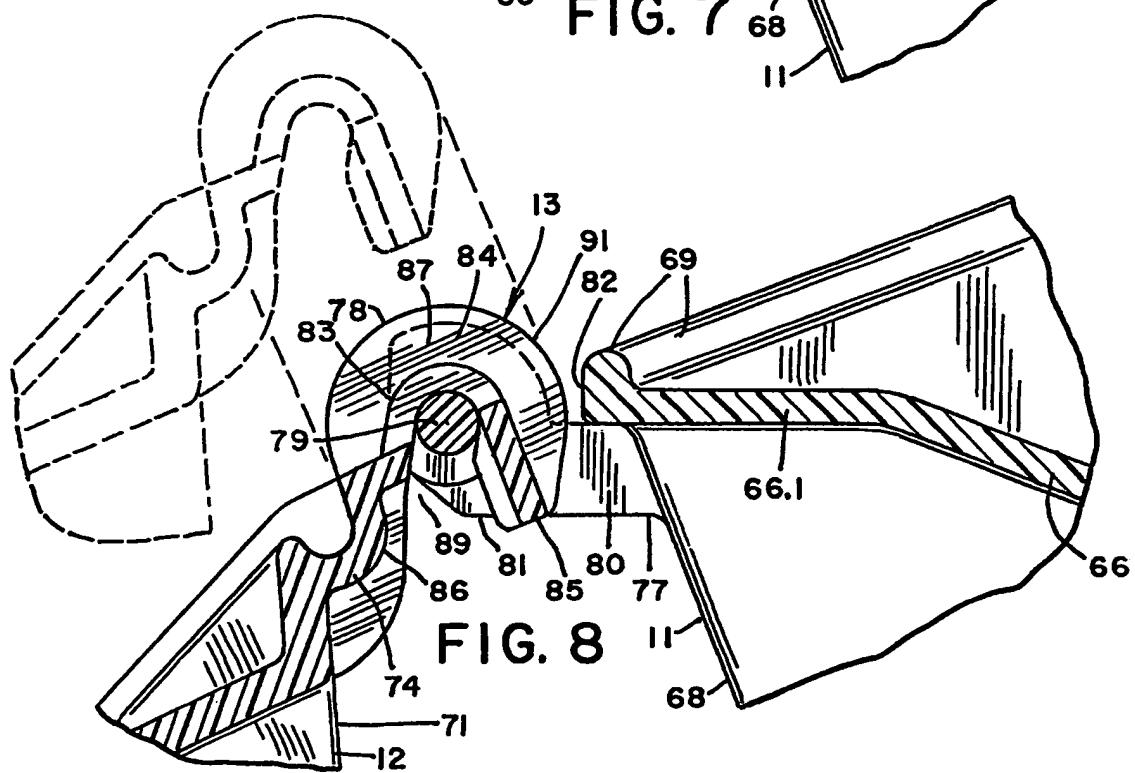
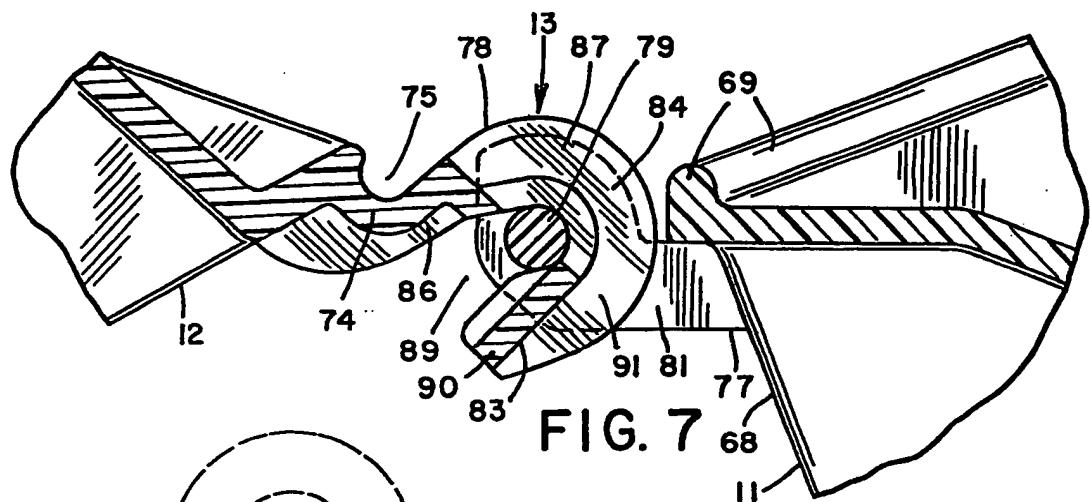
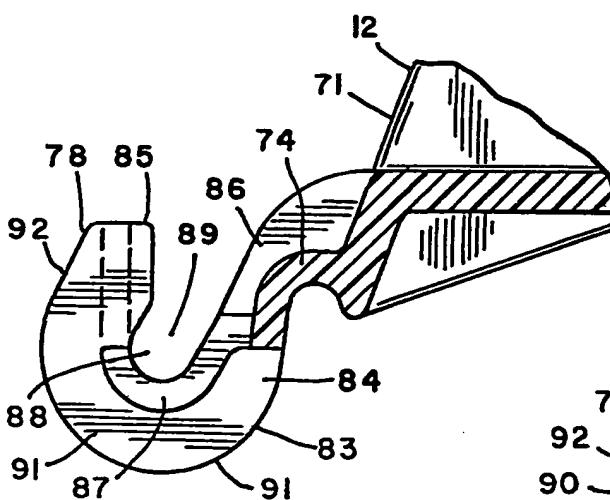
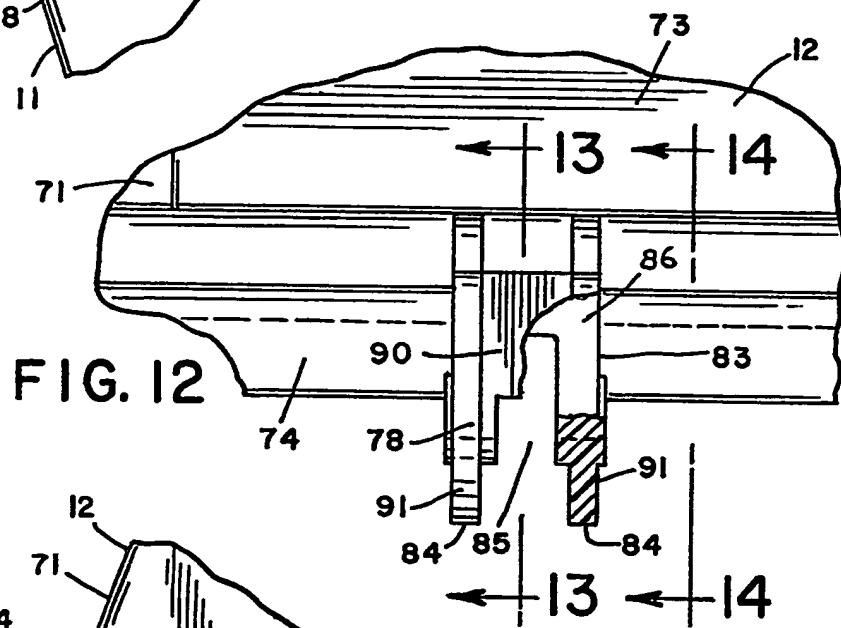
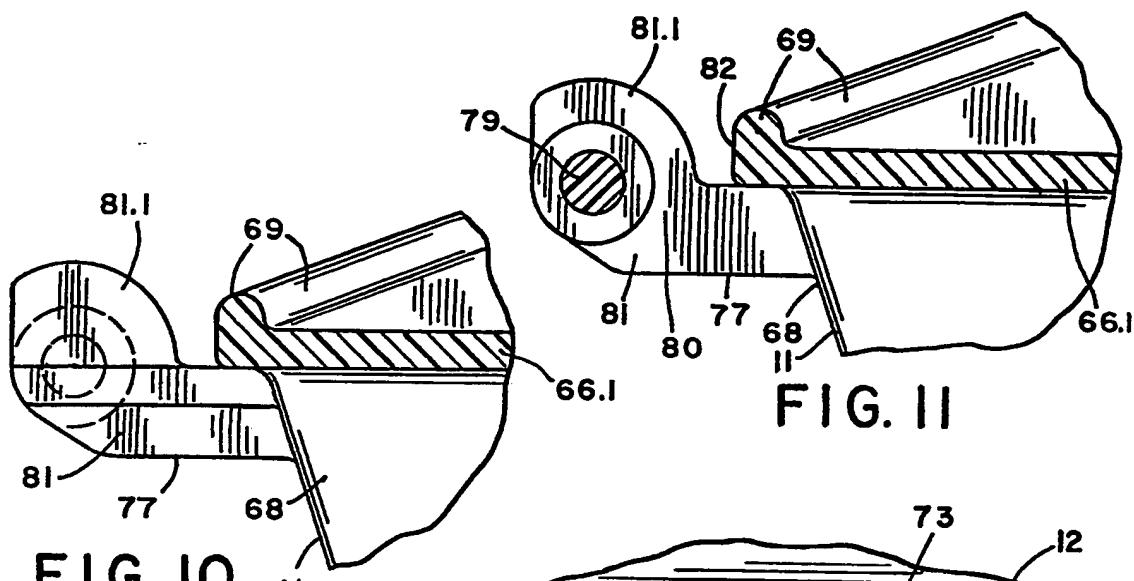


FIG. 6





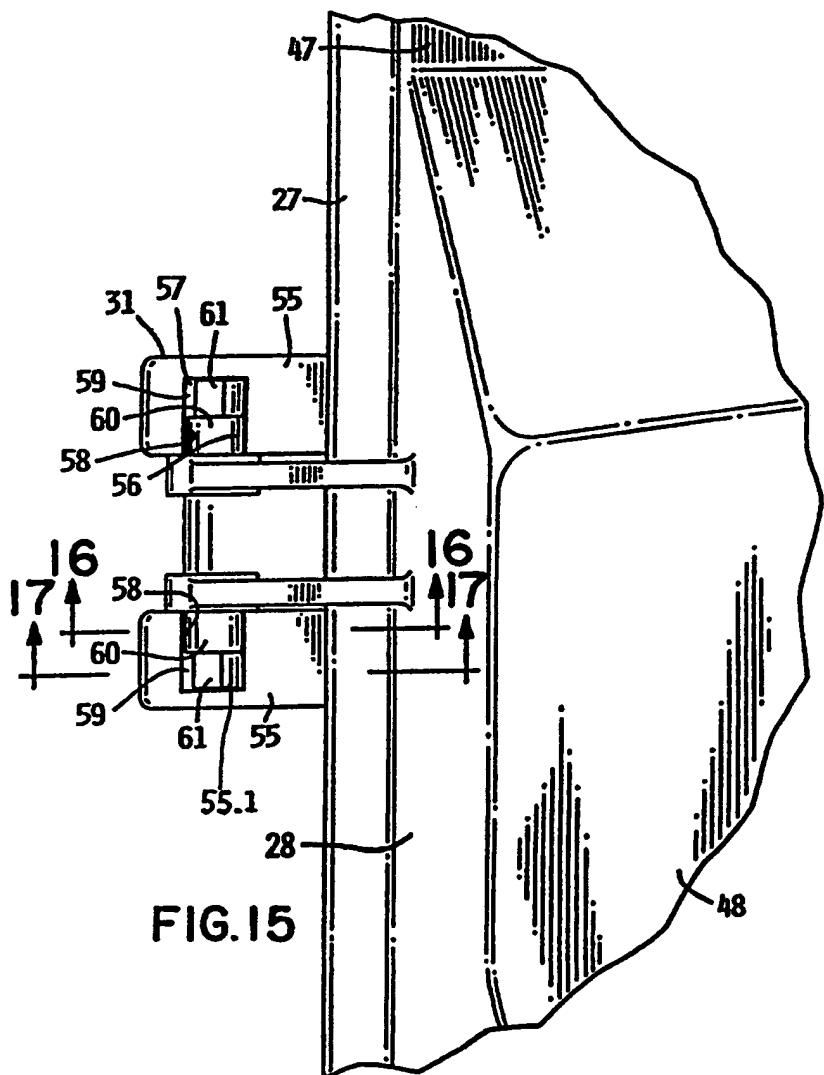


FIG. 15

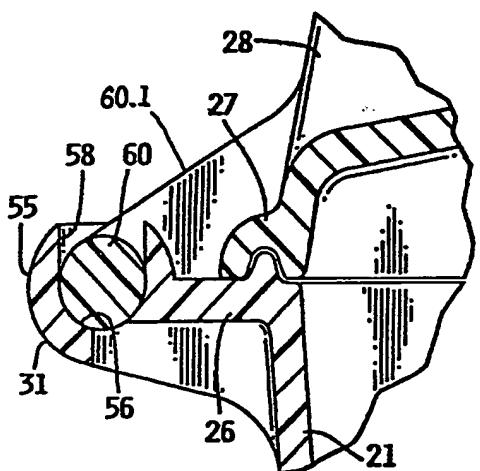


FIG. 16

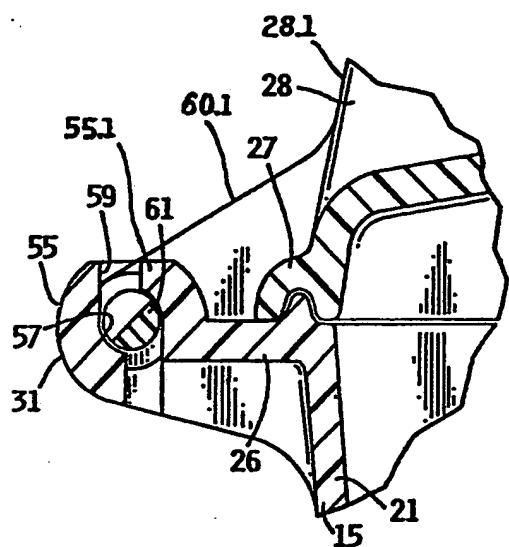


FIG. 17

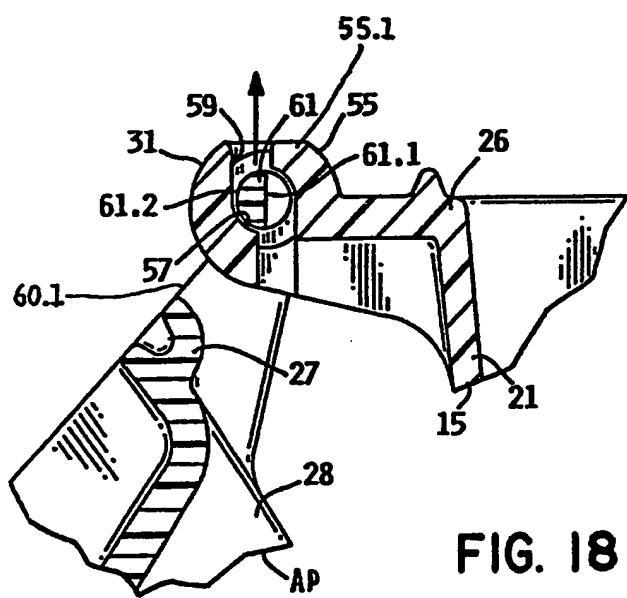


FIG. 18

BOX FOR STORING A WAFER CARRIER

This invention relates to a box for storing a wafer carrier. The wafer carrier may contain semiconductor wafers being stored temporarily while the wafers are being processed. The invention relates particularly to the hinge structure of such a box.

Semiconductor wafers, while they are being processed, are handled very carefully and are confined against general atmospheric conditions in order that the wafers contained in such a wafer carrier will not be contaminated by particles which may be airborne or otherwise carried to the wafers. In the handling of such wafers, the entire carrier is stored in a box between the various steps to which the wafers are being subjected in their processing; and the boxes may be moved about a plant or a cleanroom for processing, or may be shipped from one location to another.

The boxes made for confining such wafer carriers are molded of plastic and are preferably reusable several times. It is desirable to be able to clean the boxes between their uses so as to minimize any possibility of particles and other contaminants being collected on or near the boxes and as to remove any static charge that may exist on the boxes. In the cleaning operation, it is very desirable to remove the cover entirely from the box bottom so that it may be cleaned independently. The configuration of the box bottom and the cover and the hinging parts are such as to minimize any likelihood of trapping contaminants during and after the cleaning operation. Of course, unintentional separation of the cover from the box bottom is to be avoided during the

normal use of the box. However, the cover should be readily reassembled with the box bottom when the cleaning operation has been completed so that the box may be put back into service.

An object of the invention is to provide an improved hinge on a box for storing wafer carriers to permit removal of the cover from the box bottom.

According to the present invention there is provided a box for storing a carrier of semiconductor wafers, the box being moulded from a plastics material, and comprising

a box bottom comprising a bottom wall and bottom sidewalls defining a top rim portion,

a cover comprising top sidewalls defining a bottom rim portion lying on the top rim portion of the box bottom,

and a two-part demountable hinge assembly interconnecting the rim portions of the box bottom and cover and comprising rotatable and stationary hinge parts, one of the hinge parts comprising an insert portion and the other of the parts comprising a socket portion and an entrance-exit passage for the insert portion, the stationary and rotatable hinge parts also comprising cooperating obstruction portions confronting each other and preventing removal of said insert portion from the socket portion and entrance-exit passage except when the box cover and rotatable hinge part have been swung and rotated to and past inverted position wherein portions of the cover are below the bottom wall of the box bottom.

The present invention further provides a box for storing a carrier for semiconductor wafers, the box being moulded from a plastics material, and comprising

a box bottom comprising a bottom wall and bottom sidewalls defining a top rim portion,

a box cover comprising top sidewalls defining a bottom rim portion lying on the top rim portion of the box bottom,

a two-part demountable hinge assembly interconnecting the rim portions of the box bottom and the box cover, the hinge assembly comprising a horizontal hinge pin spaced horizontally outwardly from and extending parallel to the top rim portion of the box bottom to define a receiving space between the hinge pin and the rim portion, the hinge pin also comprising end portions with bracket means thereon and attached to the adjacent top rim portion of the box bottom,

the hinge assembly also comprising a hinge hook comprising distal and proximal end portions and a medial portion between said end portions and defining an inner socket portion receiving said hinge pin to revolve around the hinge pin, the proximal end portion of the hinge hook extending through the receiving space adjacent the hinge pin and being affixed to the bottom rim portion of the box cover, the end portions of the hook also defining an entrance-exit passage providing access to the socket portion, the hinge hook also comprising an outer guide rim spaced from the socket portion and extending partially circularly about the socket portion and on both end portions and the medial portion of the hinge hook, the guide rim also extending through the receiving space and closely adjacent the rim portion of the box bottom.

A preferred feature of the invention is a hinge which has a socket portion on one part of the box and a hinge pin portion on the other part of the box, the socket retaining the hinge pin throughout normal opening and closing of the cover onto the box bottom and the socket portion having an access or entrance-exit slot or passage oriented to permit the removal of the hinge pin when the cover is fully opened and additionally swung to an alternative position below the level of the surface upon which the box bottom is sitting.

Another preferred feature of the invention is the provision of a partable hinge on a wafer carrier box wherein the swingable and stationary hinge parts have smoothly shaped surfaces which can be readily and thoroughly cleaned when separated.

Still another preferred feature is to provide a demountable hinge on a moulded plastic box for storing wafer carriers wherein the stationary hinge part on the box bottom comprises a simple cylindrical hinge pin extending between a pair of mounting brackets and the swingable part on the cover comprises a hook providing a socket and an entrance-exit passage to receive the hinge pin and bight portions of the hook to engage the top rim portion of the box bottom and prevent removal of the hook from the pin, and an entrance-exit passage or slot into the socket and extending upwardly and at an oblique angle toward the box cover as to require that the cover be entirely inverted and swung past inverted position in order to remove the cover.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, of which:

Figure 1 is a side elevation view of a molded plastic box showing the cover in dotted lines in partially open position and in a position past inverted position;

Figure 2 is a detail elevation view of a portion of the rear side of the box;

Figure 3 is an enlarged detail section view taken approximately at 3-3 of Figure 2;

Figure 4 is an enlarged detail section view taken approximately at 4-4 in Figure 2; and Figures 4-8 show progressive views of the hinge assembly during opening and inverting of the box cover to the past inverted position where, as indicated in Figure 8, the cover may be detached from the box bottom;

Figure 9 is a detail plan view of the stationary hinge part attached to the box bottom;

Figure 10 is an enlarged detail section view taken approximately at 10-10 in Figure 9;

Figure 11 is an enlarged detail section view taken approximately at 11-11 in Figure 9;

Figure 12 is a detail plan view of the rotatable hinge part on the box cover;

Figure 13 is an enlarged detail section view taken approximately at 13-13 of Figure 12;

Figure 14 is an enlarged detail section view taken approximately at 14-14 of Figure 12;

Figure 15 is a detail plan view of an alternative form of hinge structure;

Figure 16 is an enlarged detail section view taken approximately at 16-16 of Figure 15;

Figure 17 is an enlarged detail section view taken approximately at 17-17 of Figure 15, and

Figure 18 is an enlarged detail section view, like Figure 17, but with the cover and rotatable hinge assembly rotated and inverted to a position past inverted position of the cover of the box.

One form of the invention is illustrated in Figures 1-14. The plastic molded box is indicated in general by numeral 10 and has a box bottom 11 and box cover 12, detachably joined together by a two-part demountable hinge assembly 13 which facilitates raising and opening the cover to the dotted line position "O" thereof, and also to the position "P" which is past inverted position and below the level of the surface "S" upon which the box 10 may rest. The box is especially adapted for storing a wafer carrier or cassette 14 therein in an inclined position so that the wafers "W" contained in the wafer carrier will be normally positioned in an inclined position, which minimizes the

likelihood of wafers rattling around in the box during any movement thereof.

The box bottom 11 has a bottom wall 65 to engage the surface "S" and also to support the box; and a pair of panel portions 66 of the box are oriented in an inclined position for supporting the wafer carrier 14 in the inclined position illustrated in Figure 1. Additionally, the box bottom 11 has additional inclined panel portions 67 against which an end of the wafer carrier may rest as it is stored in the box. The box bottom 11 has generally upright, though slightly inclined, sidewalls 68 enclosing the box bottom. The box bottom 11 also has a peripheral top rim portion 69 which extends around the entire periphery of the sidewalls 68 of the box bottom.

The box cover 12 is shaped to fit onto the box bottom 11, and has a top wall 70 and sidewalls 71 extending around the entire circumference of the box cover. The cover 12 also has offset panels 72 and 73 oriented to confine the wafer carrier 14 in its inclined position within the box. The peripheral sidewalls 71 of the box cover 12 define the bottom rim portion 74 of the cover 12. It will be seen that the bottom rim portion 74 of the cover defines a peripheral groove 75 which receives the top rim portion 69 of the box bottom therein in a tight fitting relation. The bottom rim portion 74 of the cover also defines an obliquely downwardly extending flange 76 which shields the entire top rim portion 69 from outside influences when the box is closed.

Portions 66.1 and 73.1 of the panels 66 and 73, respectively, extend substantially horizontally out to the perimeter of the box bottom 11 and box cover 12 and cooperate with the peripheral sidewalls 68 and 71 of the box

bottom and box cover in defining the rim portions 69 and 74 and to also mount the hinge assembly 13.

The hinge assembly 13 includes a stationary hinge part indicated in general by numeral 77 affixed on the box bottom 11; and a rotatable hinge part indicated in general by numeral 78 and affixed to the box cover. The stationary hinge part comprises a horizontal hinge pin 79 extending horizontally along, but spaced outwardly from, the top rim portion 69 of the box bottom 11 as to define a receiving space 80 between the hinge pin 79 and the top rim portion 69. The end portions 79.1 of the hinge pin are formed integrally of support brackets 81 which are also formed integrally of the adjacent sidewall 68 and of the portion 66.1 of panel 66 and of the top rim portion 69 of the box bottom. As best seen in Figures 10 and 11, the bracket 81 has a partially circular bracket portion 81.1 which is formed integrally of the cylindrical hinge pin 79. Brace portions 81.2 are horizontally oriented on the bracket 81 and are also formed integrally of the adjacent portions of the box bottom to minimize any possible movement of the hinge pin 79.

The stationary hinge part 77 also includes an obstruction portion 82 adjacent the top rim portion 69 of the box bottom and adjacent the receiving space 80, to maintain the rotatable hinge part 78 in its proper position relative to the hinge pin 79 during rotation of the hinge pin and to prevent premature removal of the rotatable hinge part 78 from the box bottom.

The rotatable hinge part 78 is formed integrally of the adjacent portions of the box cover 12, including the bottom rim portion 74, panel portion 73.1, and the perimeter sidewalls 71 of the cover. The rotatable hinge part 78

defines a hinge hook 83 which is releasably attachable to the hinge pin 79. The hinge hook 83 is made up of a pair of substantially identical mirror image side portions 84 which are spaced apart from each other by an open space 85. The hook in general 83, and each of the side portions 84, have a distal or outer end portion 85, and an inner or proximal end portion 86, and a medial portion 87 which forms a bight portion of the hook. The medial or bight portion 87 of the both side portions 84 of the hook 83 define a socket portion or rounded socket cavity 88 in which the hinge pin 79 is confined as the rotatable hinge part 78 revolves around the hinge pin.

The end portions 85 and 86 of the hinge hook 83 define an entrance-exit passage 89 which extends from the socket portion 88 in a generally upward and oblique direction toward the box cover 12, and particularly toward the rear wall 71 thereof, when the box cover 12 is in closed position as illustrated in Figures 1 and 4. Adjacent end portions 85, 86 of both side portions 84 of the hook are oriented nearly linearly in an upward and oblique direction as seen in Figures 4 and 14 for establishing the orientation of the entrance-exit passage 89.

The hinge hook 83 also has a substantially planar panel 90 extending between the distal end portions 85 of the side portions 84 of the hinge hook 83. The panel 90 is formed integrally of both side portions 84 and minimizes any possible movement of the side portions 84 relative to each other. It will be recognized that the panel 90 extends entirely to the distal end portion 85 of the hook and its opposite edge is adjacent the center of the rounded socket portion 88 so that all of the lower portions of the side portions 84 of the hook 83 are open and unobstructed as to

facilitate ready and easy cleaning of this portion of the hinge assembly.

The rotatable hinge part 78 also includes a guide rim 91 on both side portions 84 of the hook 83. The guide rim 91 partially encircles the socket portion 88 from the proximal portion 86, around through the medial portion 87 and distal end portion 85 of the hook 83. The guide rim 91 forms an obstruction to confront the obstruction 82 on the stationary hinge part 77 so that the rotatable hinge part 78 is prevented from detaching from the stationary hinge part 77 until the box cover 12 and the rotatable hinge part have swung to and through inverted position and past the inverted position into the approximate position illustrated in Figure 1 and Figure 8. A substantially flat or linear edge portion 92 on the guide rim is oriented approximately parallel to the entrance-exit passage 89 to allow for smooth movement of the distal end portion 85 through the receiving space 80 of the stationary hinge part 77 when the rotatable hinge part 78 has swung far enough to assume the position illustrated in Figure 8.

It will be recognized that the obstruction effect of the guide rim stops at the distal and proximal end portions 85, 86 of the hook.

A modified hinge assembly 31 is illustrated in detail in Figures 15-18 on the plastic molded box 20, which is very similar to box 10 of Figures 1 and 2.

There are two such hinge assemblies 31, symmetrically arranged adjacent the back wall 21 of the box bottom portion 15 to accommodate swinging of the cover portion 28 to open position.

Each of the hinge assemblies 31 includes a pair of rigid and stationary hinge parts or hinge hooks 55 rigidly affixed to and formed integrally with the bottom portion 15 of the box and more specifically with the rear wall 21 thereof. Each of the hinge hooks 55 has two adjoining separate rounded cavity or socket portions 56, 57; and each of the hinge hooks 55 has two separate and adjoining elongate access slots or entrance-exit passages 58, 59 opening into the respective rounded socket portions 56, 57. It will be seen that the elongate passages 58 have the width of the entire diameter of the rounded cavity 56; and that the passages 59 are partly obstructed and have a width which is considerably less than the diameter of the rounded socket portions 57, and furthermore, the elongate passages 59 are asymmetrically arranged relative to the center axis of the rounded socket portions 57. Each of the hinge hooks 55 has a rounded lip or obstruction 55.1 reducing the size of the passage 59 compared to socket portion 57. The passages 59 extend parallel to the diameter of the rounded socket portion 57, but offset from the center of the rounded socket portion 57; and the slots also extend at acute angles with respect to radii of the rounded socket portion 57.

Each of the hinge assemblies 31 also includes a rotatable hinge part 60.1 affixed to and molded integrally with the wall 28.1 and rim portion 27 of the box cover 28. Hinge part 60.1 includes a pair of rotatable insert portions 60, 61 respectively received into the rounded cavity portions 56, 57. The insert portion 60 is a cylindrically shaped hinge pin to substantially fill the entire socket portion 56 and to provide bearing support for the cover portion 28 as it is swung from closed to open position as illustrated in Figure 1. The insert portion 60 may be lifted out of the socket portion 56 whenever the insert portion 61 may be released from its socket portion 57.

The insert portion 61 is a substantially semicylindrical eccentric as illustrated in Figures 17 and 18 and has one flat side 61.1 and one rounded side 61.2 conforming to the rounded configuration of the socket portion 57, as to have a width slightly less than the width of the entrance-exit passage 59 so that when the insert portion 61 has the proper orientation in the socket portion 57, it may be lifted out through the passage.

The orientation of the semicircular insert portions 61 relative to the cover portion 28 is to be particularly noted. The configuration of the insert portion together with the shape and location of the entrance-exit passage 59 will prevent the hinge assembly from being disassembled; i.e., the insert portion 61 is prevented from being lifted out of socket portion 57 when the cover is closed as illustrated in Figure 17. When the cover portion 28 has been inverted so as to engage the surface "S" upon which the box sits as illustrated in Figure 1, the insert portion 61 continues to be obstructed from being removed through the passage 59 because in this open position or inverted position of the cover 28, the insert portion 61 has not yet aligned with the restricted passage 59.

However, when the cover has been allowed to swing slightly further, to the alternate position indicated by dotted lines and the letter "P" in Figure 1, and indicated by the position of the cover 28 and the letter "P" in Figure 18, the insert portion 61 aligns directly with the passage 59, thus permitting the insert portion 61 to be lifted out of the socket portion 57, thus removing the cover portion 28 from the bottom portion 15 at the box.

The present invention may be embodied in other specific forms without departing from the spirit or essential

attributes thereof, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being made to the appended claims rather than to the foregoing description to indicate the scope of the invention.

CLAIMS:

1. A box for storing a carrier of semiconductor wafers, the box being moulded from a plastics material, and comprising

a box bottom comprising a bottom wall and bottom sidewalls defining a top rim portion,

a cover comprising top sidewalls defining a bottom rim portion lying on the top rim portion of the box bottom,

and a two-part demountable hinge assembly interconnecting the rim portions of the box bottom and cover and comprising rotatable and stationary hinge parts, one of the hinge parts comprising an insert portion and the other of the parts comprising a socket portion and an entrance-exit passage for the insert portion, the stationary and rotatable hinge parts also comprising cooperating obstruction portions confronting each other and preventing removal of said insert portion from the socket portion and entrance-exit passage except when the box cover and rotatable hinge part have been swung and rotated to and past inverted position wherein portions of the cover are below the bottom wall of the box bottom.

2. A box according to claim 1 wherein the socket portion and the entrance-exit passage are on the rotatable hinge part, and the stationary hinge part comprises a horizontal hinge pin affixed on the box bottom and confined in the socket portion of the rotatable hinge part.

3. A box according to claim 2 wherein the entrance-exit passage extends obliquely upwardly and toward the box cover, the obstruction portion on the stationary hinge part being horizontally spaced from the hinge pin and adjacent the top rim portion, and the obstruction portion on the rotatable hinge part comprising a guide rim partially encircling the socket portion and located radially outwardly therefrom, and said guide rim also extending between the hinge pin and the obstruction portion on the box bottom, the rim guide terminating adjacent the entrance-exit passage to pass the hinge pin when the cover is inverted.

4. A box according to claim 1 wherein the socket portion and entrance-exit passage are on the stationary hinge part.

5. A box according to claim 4 wherein the entrance-exit passage extends upwardly from the socket portion, the obstruction portion on the stationary hinge part partially confronts the socket portion and partially closes the entrance-exit passage, the obstruction portion on the rotatable hinge part comprising an eccentric portion rotatable into alignment with the partially closed entrance-exit passage.

6. A box for storing a carrier for semiconductor wafers, the box being moulded from a plastics material, and comprising

a box bottom comprising a bottom wall and bottom sidewalls defining a top rim portion,

a box cover comprising top sidewalls defining a bottom rim portion lying on the top rim portion of the box bottom,

a two-part demountable hinge assembly interconnecting the rim portions of the box bottom and the box cover, the hinge assembly comprising a horizontal hinge pin spaced horizontally outwardly from and extending parallel to the top rim portion of the box bottom to define a receiving space between the hinge pin and the rim portion, the hinge pin also comprising end portions with bracket means thereon and attached to the adjacent top rim portion of the box bottom,

the hinge assembly also comprising a hinge hook comprising distal and proximal end portions and a medial portion between said end portions and defining an inner socket portion receiving said hinge pin to revolve around the hinge pin, the proximal end portion of the hinge hook extending through the receiving space adjacent the hinge pin and being affixed to the bottom rim portion of the box cover, the end portions of the hook also defining an entrance-exit passage providing access to the socket portion, the hinge hook also comprising an outer guide rim spaced from the socket portion and extending partially circularly about the socket portion and on both end portions and the medial portion of the hinge hook, the guide rim also extending through the receiving space and closely adjacent the rim portion of the box bottom.

7. A box according to claim 6 wherein the entrance-exit passage extends upwardly from the socket portion as to require that the box cover be at least completely inverted to facilitate the removal of the cover from the box bottom.

8. A box according to claim 6 wherein the entrance-exit passage extends upwardly and obliquely toward the box cover from the socket portion as to require that the box cover be rotated to and beyond inverted position to facilitate removal of the cover from the box bottom.

9. A box according to any one of claims 6 to 8 wherein said hinge hook comprises a pair of mirror image side portions spaced from each other and each of said side portions comprising said distal and proximal end portions and said medial portion and said guide rim, said side portions being adjacent the respective bracket means and receiving adjacent end portions of the hinge pin in said socket portions.

10. A box according to claim 9 wherein said hinge hook also comprises a panel portion extending between and affixed to the distal end portions of the side portions of the hinge hook.

11. A box according to claim 5 and said eccentric portion of the rotatable hinge part comprising a semicylindrical portion of the rotatable hinge part.

12. A box according to claim 5 wherein the socket portion comprises a rounded socket cavity confining the insert portion, the entrance-exit passage being asymmetrically arranged relative to the center axis of the rounded cavity, the insert portion having a size coordinated with the size of the entrance-exit passage to pass therethrough.

13. A box according to claim 12 wherein the elongate entrance-exit passage is oriented parallel to and offset from a diameter of the rounded cavity.

14. A box according to claim 12 or claim 13 wherein the insert portion comprises a flattened side and rounded side corresponding to the shape of the rounded cavity.

15. A box according to claim 13 or claim 14 wherein the bottom wall of the box bottom is to be placed upon a supporting surface and wherein, in said inverted open position, the box cover engages such a supporting surface, and said cover being swung below said surface and the bottom wall to facilitate removal of the box cover from the box bottom.

16. A box for storing a carrier of semiconductor wafers, the box being substantially as described herein with reference to, and as illustrated by, Figs. 1 to 14 or Figs. 15 to 18 of the accompanying drawings.

**Patents Act 1977**  
**Examiner's report to the Comptroller under**  
**Section 17 (The Search Report)**

Application number

GB 9302642.5

**Relevant Technical fields**

- (i) UK CI (Edition K ) B8P (PL4, PL5, PK5)  
                           E2F (FCK, FCL, FCQ, FCX, FPD)  
  
 (ii) Int CI (Edition 5 ) B65D 43/14; 43/16; E05D 1/04;  
                           1/06

**Search Examiner**

MIKE HENDERSON

**Databases (see over)**

(i) UK Patent Office

(ii)

**Date of Search**

15 MARCH 1993

Documents considered relevant following a search in respect of claims 1,2,4,6

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	US 4549670 (TRENDLER) whole specification relevant	1,2,4,6
X	US 4349120 (DINARDO) whole specification relevant	1,2,4,6



Category	Identity of document and relevant passages	Relevant to claim(s)

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